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5 JULY 2008  
Date of Certificate

Zachary T. Wobensmith  
Signature

In re the Patent Application of:  
JOSEPH B. KEJHA et al  
Serial No. 110/534,313

Art Unit: 1795  
Examiner: WEINER, LAURA S.

Title: CATHODE COMPOSITIONS AND METHOD FOR LITHIUM-ION  
CONSTRUCTION HAVING A LITHIUM COMPOUND ADDITIVE ELIMINATING  
IRREVERSIBLE CAPACITY LOSS

**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE**

Vero Beach, FL 32967-2871  
July 5, 2008

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Sir:

In the above matter, in response to the Final Action of the Examiner dated December 20, 2007, (three month reply period), enclosed herewith is original and three (3) copies of Brief of Appellants, Filing Fee, and Postcard receipt.

Respectfully submitted,

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**IN THE UNITED STATES PATENT AND TRADEMARK OFFICE  
BEFORE THE BOARD OF PATENT APPEALS AND  
INTERFERENCES**

Application of: JOSEPH B. KEJHA et al

Examiner: WEINER, LAURA S.

Serial No. 10/534,313

Art Unit: 1795

Filed: 05/09/2005

Title: Cathode Compositions and Method for Lithium-Ion Construction Having a Lithium  
Compound Additive Eliminating Irreversible Capacity Loss

**BRIEF OF APPELLANTS**

This is an appeal from the final rejection of the Examiner dated December 20, 2007, rejecting claims 1-6, and 10, being all the rejected claims in the case. This brief is accompanied by the requisite fee set forth in Sec. 1.17(f).

**REAL PARTIES IN INTEREST**

The real parties in interest are Joseph B. Kejha, W. Novis Smith, and Lithchem International.

**RELATED APPEALS AND INTERFERENCES**

There are no related appeals and interferences.

**STATUS OF ALL CLAIMS**

This application was filed on May 9, 2005. Claims 1-6 of this application were rejected on August 2, 2007, claims 7, 8, 11 and 12 were withdrawn from consideration, and claims 9 and 10 were objected to. An amendment was filed on November 5, 2007. Claims 1-6, and 10 were finally rejected on December 20, 2007.

The status of the claims is as follows:

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Allowed claims: None

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Cancelled claims: 7, 8, 9, 11, and 12

Claims objected to: None

Claims rejected: 1-6, and 10.

Claims 1-6, and 10, were rejected under 35 U.S.C. Sec. 102(b)/(e) as anticipated by, or in the alternative under 35 U.S.C. Sec. 103(a) as obvious over the U.S. Patent to Barker No. 6,468,695..

Claims 1-3, 5-6, and 10 were rejected under 35 U.S.C. Sec. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. Sec. 103(a) as obvious over the U.S. Patent to Xue, No. 5,928,812.

Claims 1-3, 5-6, and 10 were rejected under 35 U. S. C. Sec. 102(b) as anticipated by or, in the alternative under 35 U.S.C. Sec. 103(a) as obvious over the U.S. Patent to Endo et al, No. 6,022,641.

Claims 1-3, 5-6, were rejected under 35 U. S. C. Sec. 102(e) as anticipated by or, in the alternative, under 35 U. S. C. Sec. 103(a) as obvious over the U. S. Patent Publication to Zhang No. US2002/0119375.

Appellants appeal the final rejection of claims 1-6, and 10 inclusive.

#### **STATUS OF AMENDMENTS**

All amendments have been entered.

## **SUMMARY OF CLAIMED SUBJECT MATTER**

Applicants' invention is directed to the complete elimination of the irreversible capacity loss, which may occur upon the first charging cycle of a lithium-ion cell due to the formation of a passivation layer on the carbon anode surface. The elimination of the irreversible loss is accomplished by admixing an inexpensive and lightweight lithium carbonate ( $\text{Li}_2\text{CO}_3$ ), or other such lithium compound additive into any lithium based electrode (cathode) slurry or paste, before coating the slurry onto a substrate. The slurry may comprise, for example, a lithiated metal oxide (such as  $\text{LiCoO}_2$ ,  $\text{LiNiO}_2$ ,  $\text{LiMn}_2\text{O}_4$ ,  $\text{LiCoNiO}_2$ ,  $\text{LiV}_2\text{O}_5$ , etc.) or any lithiated cathode material, carbon black, a binder, and optionally a solvent. The slurry is coated, or extruded and pressed onto a metal current collector substrate, and the solvent is evaporated if necessary, to form the cathode electrode, which may be used in a lithium-ion cell.

It has also been found that the  $\text{Li}_2\text{CO}_3$  and other lithium compounds decompose electrochemically in the cell upon charge. This extra lithium from the lithium compound replaces the lithium irreversibly lost in passivating the anode carbon surface, or any lithium-ion anode surface, and 100% of the lithium capacity from the lithiated cathode material is then available for cycling. The irreversible capacity loss is thus completely eliminated. The excess  $\text{CO}_2$  by-product gas is vented out. Other metal compounds can be similarly used, matching the selected chemistry of the cell.

The FIG. is a graph of tests of a cell having a cathode composition constructed in accordance with the invention.

Claim 1 is related to the specification and drawings as follows: "A cathode composition for use in the cathode of lithium-ion cells, which has a lithiated cathode

material and a lithium compound additive therein" (P4, lines 17- 22, P5, lines 1-5). Claim 2. is related to the drawing and specification as follows:( P4, lines 17-22, P5 lines 1-5, P8, lines 15-24).

**GROUND OF REJECTION TO BE REVIEWED ON APPEAL**

1. Was the Examiner's rejection of claims 1-6, and 10, under 35 U. S. C. Sec. 102(b)/(e) as anticipated by, or in the alternative under 35 U.S.C. Sec. 103(a) as obvious over the U. S. Patent to Barker No. 6,468,695 in error?
2. Was the Examiner's rejection of claims 1-3, 5-6, and 10 under 35 U. S. C. Sec. 102(b) as anticipated by or, in the alternative under 35 U.S.C. Sec.103(a) as obvious over the U. S. Patent to Xue, No. 5,928,812 in error?
3. Was the Examiner's rejection of claims 1-3, 5-6, and 10 under 35 U. S. C. Sec. 102(b) as anticipated by or in the alternative under 35 U.S.C. Sec. xxx 103(a) as obvious over the U. S. Patent to Endo et al No. 6,022,641 in error?
4. Was the Examiner's rejection of claims 1-3, 5-6, under 35 U. S. C. Sec. xxx 102(e) as anticipated by or in the alternative under 35 U. S. C. Sec. 103(a) as obvious over the U. S. Patent Publication to Zhang No. US 2002/0119375 in error ?

## **ARGUMENTS**

The claims do not stand or fall together.

Claim 1 calls for a cathode composition for use in the cathode of lithium-ion cells, which has a lithiated cathode material, and a lithium compound additive, which additive reduces or eliminates the initial irreversible capacity loss of the cells upon initial charging. Claim 1 is not anticipated by or obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 2 calls for a cathode composition for use in the cathode of lithium-ion cells, which has a lithiated cathode material, and a lithium compound additive therein, which additive is selected from the group comprising: Lithium carbonate, lithium sulfite, lithium oxide, lithium nitride, lithium borate, lithium fluoride, lithium oxolate, and their mixtures, which additives reduce or eliminate the irreversible capacity loss of the cells upon initial charging. Claim 2 is not anticipated by or obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 3 dependent on Claims 1 or 2, with all their limitations calls for the lithium compound additive to be present in the cathode of lithium-ion cells in the range of 0.1% to 10% by weight. These additives reduce or eliminate the initial irreversible capacity loss of the cells. Claim 3 is not anticipated by or obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 4 dependent on Claim 1 with all its limitations calls for the cathode composition to include Polyvinylidene Fluoride/Hexafluoropropylene, a Plasticizer or an electrolyte,  $\text{LiCoO}_2$ ,  $\text{Li}_2\text{Co}_3$ , and Super-P carbon.

Claim 4 is not anticipated by or obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 5 dependent on Claims 1 or 2, with all their limitations calls for the composition to contain a lithium compound additive in the range molecularly equivalent to 2% to 40% of the lithium-ions contained in the lithiated cathode material. Claim 5 is not anticipated by or obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 6 dependent on Claim 1 with all its limitations calls for a cathode composition for lithium-ion cells in which the lithium compound additive contains more than 10% of lithium by weight. Claim 6 is not anticipated by or obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

Claim 10 dependent on claims 1 or 2 with all their limitations calls for a lithium-ion cell which has balanced capacities of electrodes. Claim 10 is not anticipated by or obvious in view of the patents, or application publications cited by the Examiner, and defines novel and patentable subject matter.

1. The Examiner's rejection of claims 1-6, and 10, under 35 U.S.C. Sec. 102(b)(e) as anticipated by, or in the alternative under 35 U.S.C. Sec. 103(a) as obvious over the U.S. Patent to Barker No. 6,468,695 was in error.

The Examiner's position is that:

“ 2. Claims 1-6, 10 are rejected under 35 U.S.C. 102(b)/(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Barker (WO 01/13443)(6),468,695).

Barker ('695) teaches on page 9, lines 21-49, a cathode electrode comprising 72.6 LMO, 0.3 lithium carbonate (LiC03) additive, 3.0 carbon, 7.5 binder and 16.7 plasticizer. Barker teaches that the carbon was Super P carbon and the binder was Kynar Flex 2801 binder (PVDF-HFP). Barker teaches in column 8, lines 1-4, that LiMn204 (LMO), LiCo02 can be used.

Since Barker teaches the same cathode material comprising LiCo02, the same Li2C03 additive, Super P carbon, PVDF-HFP and a plasticizer then inherently the same cathode would contain an additive which reduces or eliminates initial irreversible capacity loss of said cells must also be obtained.

In addition, the presently claimed property of a cathode containing an additive which reduces or eliminates initial irreversible capacity loss of said cells would have obviously have been present once the Barker product is provided. *In re Best*, 195 USPQ 433 (CCPA 1977).”

The U.S. Patent to Barker No. U.S. 6,468,695 B1 calls for a method of treating spinel lithium manganese oxide particles by forming a mixture of the particles and lithium hydroxide, heating the mixture to decompose the lithium hydroxide to provide treated spinel lithium manganese oxide, which has a reduced surface area and increased lithium content over untreated spinel lithium manganese oxide. There is no recognition or even any mention in the Barker patent concerning the formation of a passivation layer on the anode surface upon the initial charging cycle which causes an irreversible capacity loss,



nor would using the teachings of the Barker patent eliminate the irreversible capacity loss. Accordingly Barker does not anticipate or make obvious applicant's invention 1-3, 5-6.

2. The Examiner's rejection of claims 1-3, 5-6, and 10 under 35 U.S.C. Sec. 102(b) as anticipated by or, in the alternative under 35 U.S.C. Sec. 103(a) as obvious over the U.S. Patent to Xue, No. 5,928,812 was in error

The Examiner's position is that:

"3. Claims 1-3, 5-6, 10 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 102(a) as obvious over Xue (5,928,812).

Xue teaches in column 8, a cathode comprising 64.7 wt% of LiMn<sub>2</sub>O<sub>4</sub>, 2.0% Li<sub>2</sub>CO<sub>3</sub>, 12.2 wt% PVDF-HFP, 5 wt% carbon black and 16.1 wt% plasticizer.

Since Xue teaches a lithiated cathode material and the same Li<sub>2</sub>CO<sub>3</sub> additive then inherently the additive which reduces or eliminates initial irreversible capacity loss of said cells must also be obtained.

In addition, the presently claimed property of an additive reducing or eliminating initial irreversible capacity loss of said cells would have obviously have been present once the Xue product is provided. *In re Best*, USPQ 433 (CCPA1977)."

The US Patent to Xue, No. 5,928,812, discloses solid state rechargeable lithium-ion cells which are reported to have improved shelf life, cycle life and reduced impedance growth. The Xue patent calls for a non-cathode active lithium compound containing one or more non-metallic elements, substantially insoluble in the non-aqueous electrolyte of the cell, which is dispersed throughout the cathode, and within at least one

of the anode or separator. Applicants' compound additive is not in the anode or separator.

The Xue Patent does not recognize or discuss the formation of a passivation layer upon initial charging on the anode surface of a lithium-ion cell.

Xue's compound does not reduce or eliminate the irreversible lithium loss from the cathode, which occurs on the initial charging cycle of the cell, nor does his patent even remotely contemplate such action. Accordingly, Xue does not anticipate nor are applicants' claims 1-6, and 10 obvious in view of Xue.

3. The Examiner's rejection of claims 1-3, 5-6, and 10 under 35 U.S.C. Sec. 102(b) as anticipated by or in the alternative under 35 U.S.C. Sec. 103(a) as obvious over the U.S. Patent to Endo et al was in error.

“ 4. Claims 1-3, 5-6, 10 are rejected under 35 U.S.C. 102(b) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) was obvious over Endo et al. (6,022,641).

Endo et al. teaches in column 2, incorporating a specific amount of an alkali metal carbonate 0.5-20% by weight into the cathode comprising manganese oxide or lithium-manganese complex oxide is known. Endo et al. teaches in column 7-8, Examples 1-4, a cathode comprising lithium-manganese composite oxide,  $\text{Li}_2\text{CO}_3$ , a conductive graphite material, a binder of polyvinylidene fluoride and dimethylformamide.

Since Endo et al. teaches a lithiated cathode material and the same  $\text{Li}_2\text{CO}_3$  additive then inherently the same additive which reduces or eliminates initial irreversible capacity loss of said cells must also be obtained.

In addition, the presently claimed property of an additive reducing or eliminating initial irreversible capacity loss of said cells would obviously have been present once the Endo et al. Product is provided. *In re Best*, 195 USPQ 433 (CCPA 1977).”

The U.S. Patent to Endo et al. No. 6,022,641, discloses a non-aqueous electrolyte secondary cell, which comprises a cathode, which is restricted to using manganese oxide, or lithium-manganese oxide combined with sodium carbonate, which are said to retain the discharge capacity over time of the cell. The Endo et al compound does not reduce or eliminate the irreversible capacity loss upon initial charging of the cell, nor does it even remotely contemplate such action. Accordingly Endo et al does not anticipate nor are applicants' claims 1-3, 5-6, and 10 obvious in view of Endo et al.

4. The Examiner's rejection of claims 1-3, 5-6, under 35 U.S.C. Sec. 102(e) as anticipated by or in the alternative under 35 U.S.C. Sec. 103(a) as obvious over the U.S. Patent Publication to Zhang No. US 2002/0119375 was in error.

The Examiner's position is that:

- “5. Claims 1-3, 5-6 are rejected under 35 U.S.C. 102(e) as anticipated by or, in the alternative, under 35 U.S.C. 103(a) as obvious over Zhang (US2002/0119375).

Zhang teaches on page 4, Example II, a cathode comprising LiCoO<sub>2</sub> treated with various amounts of LiBO<sub>2</sub>. Example II, teaches having amounts of 0.1 wt% LiBO<sub>2</sub> and 0.15 wt% LiBO<sub>2</sub>.

Since Zhang teaches the same cathode material comprising LiCoO<sub>2</sub> and a lithium compound additive then inherently the same additive which reduces or eliminates initial irreversible capacity loss of said cells must also be obtained.

In addition, the presently claimed property of a cathode containing an additive which reduces or eliminates initial irreversible capacity loss of said cells would have obviously have been present once the Zhang product is provided. *In re Best*, 195 USPQ 433 (CCPA 1977).”

The U.S. Patent Application Publication to Zhang No. U.S. 2002/0119375 A1, discloses the use of Lithium Borate in non-aqueous rechargeable lithium batteries to reduce the fade capacity after cycling. This publication is limited to the use of lithium borate powder in a cathode powder, which contains a transition metal oxide powder, which composition is said to reduce the fade capacity of the battery. Zhang does not recognize or even contemplate that a passivation layer is formed on the carbon anode surface upon the initial charging of a lithium-ion cell.

The compound described by Zhang would not act to reduce or eliminate the irreversible loss upon initial charging of a lithium-ion cell. Accordingly Zhang does not anticipate nor are applicants' claims 1-3, 5-6, obvious in view of Zhang.

It should be noted that none of the prior art patents or application publications cited by the Examiner recognize that upon initial charging of a lithium-ion cell that a passivation layer is formed on the carbon anode surface resulting in an irreversible capacity loss.

None of the prior art patents cited by the Examiner provide compounds that would be useful to reduce or eliminate irreversible capacity loss upon initial charging of a lithium-ion cell.

In order to establish a prima facie case of obviousness, the prior art teachings must be sufficient to suggest the making of the claimed construction. Here there is no teaching or suggestion in the prior art of record and relied upon by the Examiner, which would have motivated one of ordinary skill in the art, at the time the invention was made,

to make the modifications to the prior art in the manner the Examiner proposes to obtain applicants' cathode compositions.

“One of the more difficult aspects of resolving questions of non-obviousness is the necessity ‘to guard against slipping into the use of hindsight.’” In re Carroll, 601 F.2d 1184, 1186, 202 USPQ 571, 572 (CCPA 1979) (quoting Graham v. John Deere Co., 383 U.S. 136 (148 USPQ 459, 474)(1965)). The Patent and Trademark Office has the burden of showing that the prior art would have taught or suggested the claimed invention to one of ordinary skill in the pertinent art, In re Clinton 527 F.2d 1226, 1228, 188 USPQ 365, 367 (CCPA 1976).

In re Shaffer, 108 USPQ 326, 229 F.2d 476 (CCPA 1956) is one of many cases in which it is pointed out that for a combination of old elements to be patentable, the elements must cooperate in such a manner as to produce a new, unobvious, and unexpected result, citing In re Kaufman, 39 CCPA (Patents) 769, 193 F.2d 331, 92 USPQ [4] and In re Lindberg, 39 CCPA (Patents) 866, 194 F.2d 732, 93 USPQ 23.

“Furthermore, as a general matter, in determining patentability, the concept of a new and useful improvement must be considered along with the actual means of achieving the improvement. In re Delancy, 34 CCPA (Patents) 849, 159 F.2d 737, 72 USPQ 477. In re Bisley, 39 CCPA (Patents) 982, 197 F.2d 355, 94 USPQ 80.”

There must have been a reason apparent at the time the invention was made to the person of ordinary skill in the art for applying the teaching at hand, in the manner proposed or the use of the teaching as evidence of obviousness will entail prohibited hindsight. In re Nomiya, 509 F.2d 566, 184 USPQ 607, 613 (CCPA 1975).

The CAFC in a well known case set forth the proper inquiry for evaluating references as:

References must be considered for all that they teach. W.L. Gore & Assoc. v. Garlock, Inc., 721 F.2d 1540, 1550, 220 USPQ 303, 311 (Fed. Cir. 1983) cert. Denied, 469 U.S. 851 (1984).\

See also In re Fritch, 23 USPQ 2d 1780 (CAFC 1992).

“ In proceedings before the Patent and Trademark Office, the Examiner bears the burden of establishing a prima facie case of obviousness based upon the prior art.” In re Piasecki, 745 F.2d 1468, 1471-72, 223 USPQ 785, 787-88 (Fed. Cir. 1984).

The Examiner has not satisfied this burden as she has not shown any objective teachings in the prior art, specifically Barker, Xue, Endo et al and Zhang which would lead one of ordinary skill in the art to make the described cathode compositions. The Examiner has not shown that knowledge generally available to one of ordinary skill in the art would have lead that individual to obtain the cathode compositions as described.

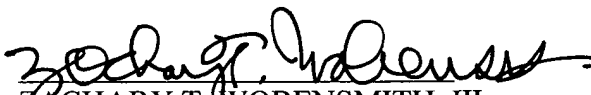
Claim 1 is separately patentable as it calls for cathode compositions for use in the cathode of lithium-ion cells, which have a lithiated cathode material with a lithium compound additive, which additive reduces or eliminates initial irreversibly capacity loss of the cells. The prior art patents and application publications only improve the cycle life of the cell. None of the prior art even recognizes the irreversible capacity loss problem, or discloses compounds that would solve this problem.

Accordingly, the Examiner has failed to meet the burden of establishing anticipation, or obviousness, and should be reversed.

### **CONCLUSION**

The Examiner has not made a prima facie case because the cathode compositions of applicants are not called for or suggested in the prior art patents or application publications to Barker, Xue, Endo et al, or Zhang. Moreover, any prima facie case has been rebutted by the showings made here.

It is believed that the claims define a new, useful, and unobvious invention. Reversal of the Examiner's rejection and allowance of the claims is respectfully requested.

  
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## **CLAIMS APPENDIX**

### **CLAIM 1.**

A cathode composition for use in the cathode of lithium-ion cells, which has a lithiated cathode material and a lithium compound additive therein, and said additive reduces or eliminates initial irreversible capacity loss of said cells.

### **CLAIM 2.**

A cathode composition for use in the cathode of lithium-ion cells which has a lithiated cathode material and a lithium compound additive therein, which additive is selected from a group comprising:

Lithium carbonate, lithium sulfite, lithium oxide, lithium nitride, lithium borate, lithium fluoride, lithium oxalate, and their mixtures, and said additives reduce or eliminate initial irreversible capacity loss of said cells.

### **CLAIM 3.**

A cathode composition as defined in Claim 1 or 2 in which said lithium compound additive is present in the range of 0.1% to 10% by weight.



CLAIM 4.

A cathode composition as defined in Claim 1 in which, said cathode composition includes:

- a. Polyvinylidene Fluoride/Hexafluoropropylene
- b. Plasticizer or an electrolyte
- c.  $\text{LiCoO}_2$
- d.  $\text{Li}_2\text{CO}_3$
- e. Super-P carbon

CLAIM 5.

A cathode composition as defined in Claim 1 or 2 in which said composition contains a lithium compound additive in the range molecularly equivalent to 2% to 40% of the lithium-ions contained in the lithiated cathode material.

CLAIM 6.

A cathode composition for lithium-ion cells as described in Claim 1, in which said lithium compound additive contains more than 10% of lithium by weight.

CLAIM 10.

A lithium-ion cell as described in Claims 1 or 2, which has balanced capacities of electrodes.

EVIDENCE APPENDIX

NONE

RELATED PROCEEDINGS APPENDIX

NONE